Materials and Fabrication of 1¼Cr-½Mo Steel Heavy-Wall Pressure Vessels for High-Pressure Hydrogen Service Operating at or Below 825 °F (440 °C)

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Introduction

This standard applies to new fabrication of heavy-wall pressure vessels in petroleum refining, petrochemical, and chemical facilities in which hydrogen or hydrogen-containing fluids are processed at elevated temperature and pressure. It is based on decades of industry operating experience and the results of experimentation and testing conducted by independent manufacturers, fabricators, and purchasers of heavy-wall pressure vessels for this service.

Licensors and owners of process units in which these heavy-wall pressure vessels are to be used may modify or supplement this standard with additional proprietary requirements.

Informative elements—As used in a standard, “informative” denotes elements that identify the document, introduce its content, and explain its background, development, and its relationship with other documents or provide additional information intended to assist the understanding or use of the document.

Normative elements—As used in a standard, “normative” denotes elements that describe the scope of the document and that set out provisions that are required to implement the standard.

Materials and Fabrication of 1¼Cr-½Mo Steel Heavy-Wall Pressure Vessels for High-Pressure Hydrogen Service Operating at or Below 825 °F (440 °C)

1 Scope

This standard covers materials and fabrication requirements for new 1¼Cr-½Mo steel heavy-wall pressure vessels and heat exchangers for high-temperature, high-pressure hydrogen service. It applies to pressure vessels that are designed, fabricated, certified, and documented in accordance with ASME Section VIII, Division 1 or Division 2. This document may also be used as a resource for equipment fabricated of 1Cr-½Mo steel.

This document may also be used as a resource when planning to modify an existing heavy-wall pressure vessel.

The interior surfaces of these heavy-wall pressure vessels may have an austenitic stainless steel or ferritic stainless steel weld overlay or cladding to provide additional corrosion resistance.

For this standard, “heavy-wall” is defined as a shell thickness 2 in. (50 mm) or greater, but less than or equal to 4 in. (100 mm) at the time of mill heat treatment. At shell or head thicknesses greater than 4 in. (100 mm), 1¼Cr-½Mo plates and forgings have been shown to have difficulty meeting the toughness requirements given in this document. Meeting the specified properties can be especially difficult with thick 1¼Cr-½Mo forgings, such as integrally reinforced nozzles, flanges, tube sheets, channel covers, etc. 2¼Cr-1Mo vessel components can be used as an alternative to ensure mechanical properties can be achieved. Although outside of its scope, this document can be used as a resource for pressure vessels below 2 in. (50 mm) in shell thickness, with changes defined by the purchaser.

Multilayer pressure vessels are outside the scope of this document.

This standard is not intended for use for equipment operating above 825 °F (440 °C) or in the creep range. API Standard 934-E covers these higher-temperature applications.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Recommended Practice 582:2023, *Welding Guidelines for the Chemical, Oil, and Gas Industries*

API Recommended Practice 934-A, *Materials and Fabrication of 21/4Cr-1Mo, 21/4Cr-1Mo-1/4V, 3Cr-1Mo, and 3Cr-1Mo-1/4V Steel Heavy Wall Pressure Vessels for High-temperature, High-pressure Hydrogen Service*

API Standard 934-E, *Materials and Fabrication of 11/4Cr-1/2Mo Steel Pressure Vessels for Service Above 825 °F (440 °C)*

ASME[1] *Boiler and Pressure Vessel Code,* Section II-*Materials;* Part A-*Ferrous Material Specifications;* Part C, *Specification for Welding Rods, Electrodes and Filler Metals;* Part D-*Properties*

ASME *Boiler and Pressure Vessel Code*, Section V-*Nondestructive Examination*

ASME *Boiler and Pressure Vessel Code*, Section VIII-*Rules for Construction of Pressure Vessels,* Division 1

ASME *Boiler and Pressure Vessel Code*, Section VIII-*Rules for Construction of Pressure Vessels*, Division 2: *Alternative Rules*

[1] ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.